Remedial Technology For Soil	Description	Disadvantages	Advantages	Notes
Excavation	Excavation of contaminated soils followed by either treatment and disposal or disposal at landfill.	Excavation below the water table is not easy and may leave contamination that still requires treatment Footprint of excavation could become quite large to avoid sidewall collapse Dewatering to get to deeper contamination would generate water that would need to be treated and disposed of offsite Dewatering may lead to increase in thickness of smear zone Excavation may be limited by encroachment of road right of way or road prism Vapor emissions from open excavation may require air monitoring for site workers and may impact local businesses and residents Potential for fugitive dust emissions May increase groundwater contamination by agitating soils beneath the water table Transportation and disposal costs are high	Complete removal of contaminated soils excavated Demonstrated success Timeframe for total removal less than 3 months Output Demonstrated success Demonstr	Can be combined with other technologies Would create more access/site control issues than other potential remedies Output Description:

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Remedial Technology For Soil	Description	Disadvantages	Advantages	Notes
Soil Vapor Extraction (SVE)	In situ method that removes volatile compounds from the subsurface using SVE wells and vacuum blower	 Treats only the unsaturated soils Requires installation of SVE wells and piping. Shallow depth to groundwater may require horizontal wells Requires above ground equipment treatment unit Off gas emission treatment would likely be required Timeframe for removal could be approximately 3 years 	Demonstrated success Treatment units readily available Moderate cost	Generally combined with air sparging Can be combined with excavation of shallow soils and installing the horizontal SVE wells during backfilling Generally combined installing the
Air Sparging (AS)	In situ method that removes volatile compounds from the subsurface using air sparge wells and compressor to blow air below the groundwater table	Requires installation of AS wells and piping to an above ground equipment treatment unit Timeframe for removal could be approximately 3 years	Demonstrated success Treatment units readily available Treats saturated soils Also supplies oxygen to stimulate biodegradation Moderate cost	Pilot study to evaluate AS well spacing and concern about potential iron fouling of the AS wells

Remedial Technology For Soil	Description	Disadvantages	Advantages	Notes
Enhanced Bioremediation	Addition of oxygen to the subsurface by either injection points, air sparging, or applying to open excavations	Requires multiple applications if an oxygen release compound or other amendment is used Unknown timeframe for successful remediation	Easy injection using direct push methods because of shallow groundwater	Injection of an oxygen release compound unlikely to receive tribal approval Oxygen release compound can be applied to an open excavation, though professional experience indicates this method has limited efficacy
Chemical oxidation	Addition of a chemical oxidant to the subsurface to destroy the contaminant.	Requires multiple applications Potential changes to groundwater geochemistry High cost	Easy injection using direct push methods because of shallow groundwater Can readily target soils beneath the water table Short treatment time (3 months to 1 year)	Injection of an oxidant unlikely to receive tribal approval

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Remedial Technology For Soil	Description	Disadvantages	Advantages	Notes
In Situ Soil Heating	Addition of heat to the subsurface to volatilize contaminants.	Requires installation of heating wells and is typically combined with SVE Off gas emission treatment may be required Condensate may be generated and would require disposal Due to significant portion of the impacted soil interval being within a saturated zone with relatively high porosity, groundwater can be a significant heat sink, which would require additional energy to heat soil Potential for groundwater passing through the treatment interval to retain heat and impact Haskell Lake High cost	Short treatment timeframe (6 to 9 months)	High energy demand that may not be readily available resulting in the need for portable generators.

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